

SEURAT: Scanned Entry of Structured Data for a Pediatric Health Maintenance Record System

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A fundamental challenge in the implementation of computer-based patient records has been acquisition of clinical information in a format that can be processed by computers. In our SEURAT Project (Scanning for Evaluation, Utilization Review, Analysis, and Training), we collect pediatric health maintenance data recorded by the provider at the point of care using electronic document scanning and recognition.

Clinical Data Requirements: Connecticut's recently instituted Medicaid managed care program mandates tracking of a large number of indicators of system utilization, clinical quality, and health status and specifies the generation of regular, detailed reports. At the time this project was conceived, there was no ambulatory, computer-based record in the Pediatric Primary Care Center at Yale New Haven Hospital from which to derive this information. We identified an essential dataset of health maintenance activities that are performed in caring for children from birth through adolescence. These data pertain to growth, nutrition, development, sleep, elimination, illness, safety, anticipatory guidance, physical examination findings, screening tests, immunizations, and demographics.

Design: We anticipated a need for considerable flexibility for our data capture system, which would permit a rapid response to changing data collection and reporting requirements. Document scanning was coupled with optical mark recognition, barcode recognition, optical character recognition, and intelligent character recognition to acquire information in a structured format for an electronic record. Sixteen, one-page forms were designed to permit scanning of structured information. Each form prompts for information entry that is relevant to a particular age range. To accommodate activities that may have been performed at our Clinic site or elsewhere, we defined four mutually exclusive health maintenance Event categories (Encounter, Measurement, Screening, and Immunization Events) that inherit an event identifier and event value and specialize additional attributes.

System Implementation: Since January 1, 1997, the structured documentation from all health maintenance encounters has been scanned, verified and entered into the SEURAT database. An average of 80 data items are collected from each form. Approximately 50 forms are processed each weekday.

The scanning software performs data validation to assure the integrity of critical information. The output of the scanning process is a separate flat file for each form type, which contains verified encounter data. Conversion software parses and inserts these data into appropriate tables in the SEURAT database, which reside on a networked server. The database provides reports for each patient that show visits by date and providers, a child's complete immunization, growth, and screening histories, as well as detailed summaries of individual encounters. In addition, reports of aggregate activities can be generated to show immunizations for a cohort of patients, provider productivity, and monthly vaccine usage.

Evaluation: The transition to structured forms produced an almost three-fold improvement in the documentation of data items relating to development and anticipatory guidance compared with the legacy system. In addition, 90% of the users expressed a preference for the structured forms. Users agreed most strongly that use of structured forms served to remind them to provide anticipatory guidance and to perform assessments and interventions they might otherwise have forgotten. Under clinical conditions, the scanning accuracy rate was 99.17%.

Conclusions: The SEURAT system captures a comprehensive view of the pediatric health maintenance encounter, including clinical observations, assessments, and interventions, using familiar paper-and-pen documentation with minimal disruption of clinical workflow. The structured format of the age-specific forms provides reminders. All advantages of the electronic medical record become available, including information access, legibility, organization, security, and aggregate reporting. Additionally, we have been able to maintain local control over form design and generation. Limitations of our scanning approach include: (a) it is impossible to capture the richness of an encounter with a finite number of data items and (b) the clinician is isolated from direct interaction with the database at the point of care. Current scanning technology can serve as a viable mechanism for the capture of clinical information recorded by clinicians at the point of care.

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